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Design of Transmission Scheme for Radiation Detection &Management Information

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Abstract: To realize digital transmission of radiation detection and management information, this paper proposes use of electronic label as information carrier. By means of network, read/write device, and other office hardware and software, cross-region transmission and all-weather free communication of radiation detection and management information can be realized. Market investigation and demonstration show that this scheme is technically reliable and economically feasible, and can satisfy demand by construction project QA/QC and digitalized management.

Keywords: Radiation detection; Management; Information; Transmission; Electronic label; Design

1. Foreword

With social development, there are more and more large-scale production activities and amount of information on welding and radiation detection is becoming larger and larger. In this context, management activities are further complicated. Development of computer technology brings a chance for radiation detection and management. To keep up radiation detection technology in this development and change modern "plowing by knife and planting by fire" operation mode, a radiation detection information transmission scheme based on electronic label is hereby proposed.

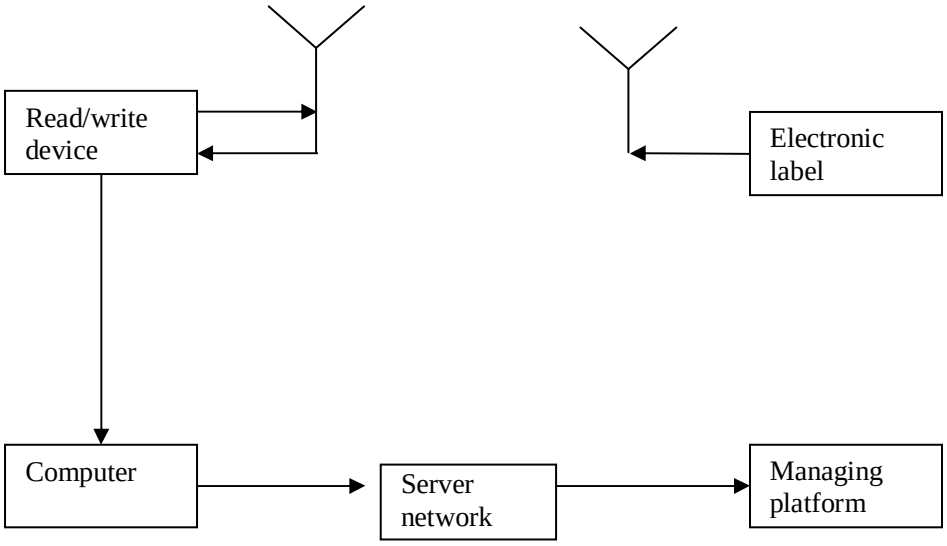
2. General design of information transmission

2.1 Outline of information transmission

Main process of communication, interchanging and feedback of welding information, detection information and management information: First, welding information including welder, weld No., date, position, material, size and welding method etc. is entered and flows to welding management layer and engineering management layer. Then, according to standards, the welding management layer will issue detection information, and detection personnel will carry out detection according to detection standards, with results of detection fed back to welding management layer and engineering management layer, thus realizing sharing of information and timely understanding of engineering dynamic trend. These processes are combined with MES ERP CRM[1] information system via RFID, and adopt XML[1] data format to constitute information chain with Internet or LAN.

2.2 General description of information transmission principle

First, charts, orders, texts and photos of welding and detection information transmission, interchange and management activities are entered as data via hardware of each terminal. Then, such data are converted to digital signals, and in application system, further converted to various new information flows serving other terminals, or directly stored in electronic labels to facilitate use by read/write device. This scheme adopts passive electronic labels. After read/write card generates RF signals, electronic labels in magnetic field generate induced current through their ability to receive RF signals, supporting energy demand for reading and writing of signals in the labels, thus fulfilling the objective of signal exchange. RFID completes automatic acquisition of fundamental data of system via non-contact type reading of data, which become original data required for information processing by computer. This is an effective tool for fast and accurate acquisition.



RFID information transmission schematic diagram

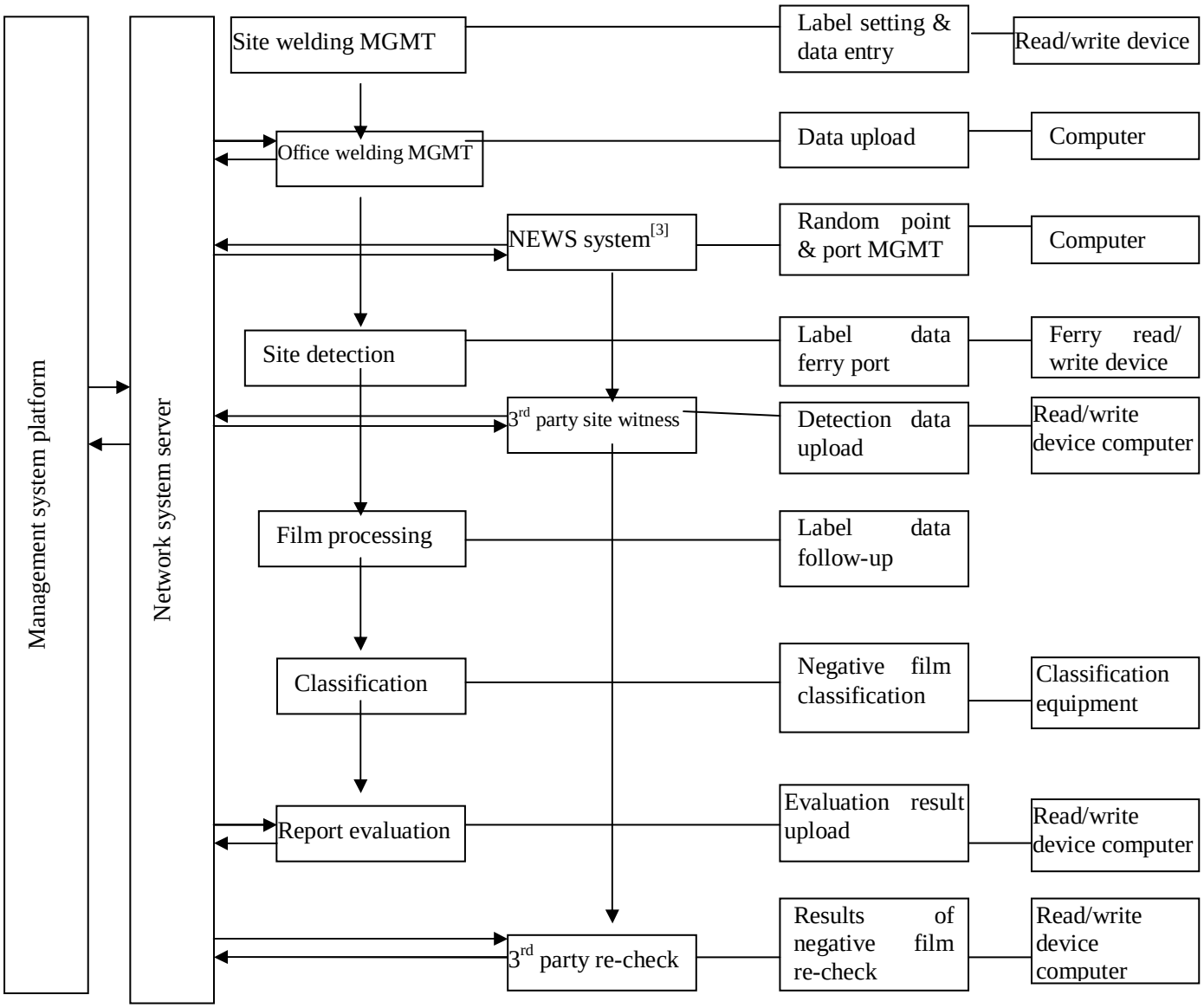
2.3 Briefs of information transmission external foundation

Foundation of information transmission in this scheme: computer terminal, Internet, electronic label, read/write device, Microsoft BizTalk RFID, popular office software, supporting software developed (present software used in China and partly supporting this scheme includes general purpose protocol supported, electronic label middleware, fundamental hardware, and relevant supporting standards etc.

2.4 Briefs of information transmission standardization

At present, main prevailing electronic label standards are: ISO/IEC, EPCglobal and uID. Therefore, for application, these standards shall be used as execution bases. Through use of mature communication protocols in RF technology, standardization now is moving toward further fusion and development. Simple technology, low costs are keys to use electronic label technology in radiation detection and management information transmission scheme.

2.5 Information transmission organization flow chart



Detection and management information activities relation flow chart

3. Information carrier scheme

3.1 Name of information carrier

Passive electronic label; bar code.

3.2 Information carrier performance

Electronic label: passive; data capacity not less than 1k; capable of 100,000 writings; operation temperature: -25℃~75℃; waterproof; easily used in liquid of PH value of 4~11 [4] ; usable in metal environment; operating frequency of 13.56Hz [1] (or other frequency bands that can be used).

Bar code: traditional 1-D or 2-D bar code; strong resistance to magnetism; resistance against ordinary acids and alkalis.

3.3 Function of information carrier

3.3.1 Electronic label

Data entry and saving electronic label and data transmission and acquisition electronic label for welding and site detection of welds: starting point of application of welding and detection data, mainly used for site welds. As storage electronic label for detection information transmission process, such label is mainly used for film follow-up, and entry of evaluation results and data into network system and application system. Stored information includes:construction infromation、inspection information、inspection object& etc. Such information can be provided by about 96 bits [1] of fundamental information code.

3.3.2 Bar code

Bar codes provide auxiliary and backup functions. In case current price of electronic labels is high or use of such labels is not convenient in automatic film developer since physical dimension (mainly thickness) is larger than that of film, data of electronic label will be temporarily converted to bar code. By storage in the bar code, data can be restored.

4. Information transmission scheme

4.1 Names of information transmission hardware

Network; interface; read/write device; computer; office auxiliary; server.

4.2 Performance of information transmission hardware

Network: LAN or Internet, of transmission speed not lower than 10k/s.

Interface: USB 2.0; API interface; read/write device interface (RS232, RS485, Ethernet interface, infrared interface).

Read/write device: frequency of 13.54MHz[1], distance not less than 10cm, weight ≤1kg, volume dimensions below 150mm×100mm×20mm, supporting 10h of continuous use when fully charged, good resistance against shock and vibration, 1G of data storage, with bar code scanning module hence allowing 2 modes of use.

Server: supporting OA/MES/ERP/SCM/CRM information system.

4.3 Functions of information transmission hardware

Network: connecting each terminal to realize data transmission.

Interface: allowing mutual connection and matching of each item of hardware to meet requirements.

Read/write device (several in one): providing connection of site equipment and integration with upper layer application software system.

This device is the foundation of connection between electronic label and application system.

Server: information service.

5. Information transmission scheme

5.1 Names of information support software

Database, operation platform, software, language, middleware.

5.2 Requirements on information support software

Database: enterprise resource database and office database suitable for sharing and application of management and detection data.

Operation platform: WINDOWS memory not less than 512M at present.

Language: standardization of communication, popularization of product, generalization of application, and simplification of technology.

Software: Stable and reliable performance; suitable for environmental condition of construction site; good confidentiality in data transmission and saving; good compatibility. Other software shall be medium grade of mutual compatibility and development, operation in existing software, and good stability, e.g. BizTalk Server2006R2. With Web service as interface, such software will be integrated into RFID frame based on SOA, to construct RFID PSI that features information reception, conversion, interaction and summarizing etc.

Middleware: standardized, plug-in type.

5.3 Functions of information support software

Database: Site of storage of large amount of data. It is an integral body organized by certain logic structure in a unified manner, adapting to constant change of data and business.

Operation platform: construct communication system and realize sharing of information.

Language: for communication.

System software: construct system platform to support various services, realize management of RFID data and bar code information, realize service functions based on Internet, and construct blue tooth wireless office network mechanism.

Middleware: data filtration and assortment, data routing and integration, process management, coordination with read/write device, standard integration, and coordination with software integration.

6. Feasibility market investigation

6.1 Technical feasibility

R&D equipment, software compilation, and technical foundation can utilize existing technologies. Electronic label and matching read/write device are mature technology widely and reliably applied in many industries, and being developed fast. Non-drying glue electronic label meets EPC Gen2 standard, has physical dimensions of 4"×1", can be re-written, operates at temperature of - 25℃--60℃, and has storage capacity of 128bit. Hitachi has issued on ISSCC2007 miniature RFID label of size of 0.05㎜×0.05㎜×5μm, which has a memory including 38 bits of unique ID code and will be used in retail business in 2009. Micro computers and modern auxiliary office equipment are being improved all the time. BizTalk Server2006R2 supports enterprise boundary integration via Microsoft BizTalk RFID and can be easily used. According to EPC encoding scheme structure, detection information to be loaded will be connected to it based on classes, and adherence simplicity treatment will be performed to satisfy application purpose. Special application system and exchange software of this scheme can be developed by us.

6.2 Economic feasibility

Investment mainly involves electronic labels of great quantity. At present, price of electronic label does not exceed RMB 1.5 [1] each. price of some simple chip has reached Yen 5 [1] each. Price of read/write device is within RMB 2500 [5] each, such devices are not a main part of investment. Software development mainly involves auxiliary transmission software.Some software needs no separate development, e.g. electronic label reading, writing and transmission. No separate investment is required for office equipment and network.

Yield and benefits: Transmission of digital information allows faster and more convenient management. a great advantage over traditional management. In particular, this advantage is more apparent when the project is large and complicated. In addition, less paper and ink will be used, and lead type will only be used as positioning mark in radiation detection. These environmental benefits are not to be ignored.

6.3 R&D investment

Development of one read/write device and 10 electronic labels. Compilation of one item of software connecting application system.

7. Expectation of application

With more and more large-scale socialized productions, and more and more detailed work divisions, communication is more frequent and there are more and complicated data. Digital signals of NDT technologies of radiation CR and DR technology and ultrasonic TOFD technology, as well as other detection technologies, require timely load-in, transmission, application, and storage.Modern management technology has entered the stage of digital office. NDT expert system requires timely transmission of digital signals.For radiation detection technology, application of electronic labels and digitalized information transmission can reduce use of paper and eliminate dependence on lead type. This will be revolution of traditional technology. If terminal used adopts clean energy source such as solar cells, consumption of exhausting resources such as petroleum and coal etc. can be further reduced.

8. Conclusions

With exhaustion of energy resources, application of environmental protection requirements, and development of digitizing technique, to realize harmonic co-existence of humans and nature, future of detection technology digitization is promising. This scheme proposed by this paper will

function as "throwing out a brick to attract a jade".

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